

Section 13-2 The Ozone Shield

Ozone layer: area in the stratosphere where ozone is highly concentrated

- **Ozone:** 3 molecules of oxygen (O₃)
- Absorbs most of the harmful **ultraviolet (UV) radiation** from the sun
- Acts like a sunscreen for the Earth

Chemicals That Cause Ozone Depletion

- **Chlorofluorocarbons (CFCs)**
 - Human-made chemicals
 - Nonpoisonous, nonflammable, don't corrode metals
 - Became popular as coolants in refrigerators and air conditioners and a propellant in spray cans of deodorants, insecticides, paint, etc.
 - At Earth's surface are chemically stable (don't combine or break down)
 - But CFC molecules break apart high in the stratosphere (by UV radiation)
 - Parts of the CFC molecules **destroy protective ozone**
 - **A single chlorine atom from CFC can destroy 100,000 ozone molecules**

The Ozone Hole

- Thinning of stratospheric ozone that occurs over the poles during the spring
- First discovered in 1985
- **How Does the Ozone Hole Form?**
 - During the dark polar winter, strong circulating winds over Antarctica isolate cold air from surrounding warmer air
 - Air within the vortex grows extremely cold
 - High-altitude clouds made of water & nitric acid begin to form
 - Here the products of CFCs are converted to molecular chlorine
 - When the sunlight returns to the South Pole in spring, chlorine is split into 2 chlorine atoms by UV radiation
 - The chlorine atoms rapidly destroy ozone
 - Causes a thin spot which lasts for several months
 - **Ozone from pollution can't fix the problem**
 - Ozone is very chemically reactive
 - Ozone produced by pollution breaks down or combines with other substances in the troposphere long before it can reach the stratosphere
- **Effects of Ozone Thinning on Humans**
 - UV light damages DNA
 - Makes the body more susceptible to *skin cancer*
- **Effects of Ozone Thinning on Animals & Plants**
 - High levels of UV light can kill **phytoplankton** in oceans
 - Disrupt food chains & reduce fish harvests
 - Increase the amount of CO₂ in the atmosphere
 - Especially damaging for **amphibians**
 - Lay eggs without shells in shallow water
 - More UV light may kill more eggs & put populations at risk
 - Interferes with **photosynthesis**
 - Can result in **lower crop yields**

Protecting the Ozone Layer

- **Montreal Protocol** (then a 2nd conference in Denmark)
 - Group of nations agreed to eliminate most CFCs by 1995
 - Companies developed CFC replacements
- International environmental **success story**
- **Not over:** CFCs remain active in the stratosphere for 60-120 years